Overview of DMSO C4I-Simulation Interoperability Program

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Agenda

- C4I-Simulation Interoperability Challenges
- Overview of Current DMSO C4I-Sim Initiatives
  - DII COE M&S TWG
  - Realtime Simulation Initialization from C4ISR Systems
- Potential Future Efforts

Current Challenges Involving C4I-Simulation Interoperability Across All M&S Domains

- Training
  - Lots of custom C4I-Simulation interfaces with limited opportunities for re-use and costly to maintain
  - Manual interpretation of C2 messages by response cells, before input into simulations, resulting in large manning requirements for training response cells
- Operational Analysis
  - COA simulation tools currently decoupled from C4I systems
    - Manual initialization of simulations based on C4ISR system data
    - Analysis results not easily shareable/exportable
  - No coordinated approach for the integration of decision support applications within C4ISR systems
    - Potential for “stovepiping” of these applications
- Experimentation
  - Combined C4I-Sim challenges from both the training and analysis areas
- Acquisition
  - Limited capability to stimulate C4I systems during operational testing using simulation

Objectives of the DMSO C4I-Sim Program

- Lead efforts to improve standardization and re-use of C4I-Sim interfaces across DoD
  - DMSO is the designated lead for documenting M&S requirements as part of the DII COE (Chairs the M&S Technical Working Group)
- Help to develop and demonstrate C4I-Sim technologies that can help to meet the challenges outlined previously, including:
  - Initialization of simulations for COA analysis from C4ISR systems
  - Automated interpretation of C2 messages by simulations
- Coordinate with other DoD organizations on M&S issues related to C4ISR
  - M&S and C4I planning and policy (ASD/C3I, DISA, etc.)
  - Existing C4ISR simulations and those under development (JWARS, JSIMS, NETWARS, etc.)

DII COE Overview

- The Defense Information Infrastructure (DII) Common Operating Environment (COE) consists of common software products within a single environment that can be used by multiple command and control systems
  - Reduces the need for individual C4I systems to build separate software components that would not be interoperable with other systems
  - Provides a configuration managed environment that assures that software processes within the COE do not interfere adversely with one another
- DISA manages the COE, through a process which documents requirements for software components to be added into the COE and oversees the implementation, testing, and fielding of the COE
- Technical Working Groups (TWGs) are assigned based on various C4I system functional areas (mapping, data access, COP, M&S, etc.) that define the requirements for COE software products

The M&S Technical Working Group (TWG)

- In February 2000, the COE Architecture Oversight Group (AOG) formed the Modeling and Simulation (M&S) Technical Working Group (TWG) to:
  - Identify requirements related to M&S software products that are necessary for inclusion within the COE
    - Version 1.0 available on COE Website
  - Coordinate M&S requirements with TWGs that share similar functions
    - Direct coordination with COP, Msg Processing, Realtime, and Tools TWGs
  - Coordinate the implementation of M&S segments into the COE, through conduct of preliminary design reviews (PDRs), and other mechanisms as necessary
    - Recently completed PDR for HLA RTI and GCCS Ambassador - both of which are being submitted to DISA for segmentation
- Additional Information available on M&S TWG Web Sites:
  - DISA: http://www.disa.mil/coe/aog_twg/twg/mstwg/
  - DMSO: http://www.dmso.mil/index.php?page=181

Highlights within the M&S TWG Technical Requirements Specification (TRS)

- Mgmt and Control Services
  - M&S Services
    - Mission Applications
    - Instantiation
    - Control Requirements
  - Time Management
    - Independent Time Reference (Past, Present, Future)
    - Flexible Time Ratios (Faster/Slower than realtime)
    - Standard Simulation Play Control
  - Communications
    - Send and Receive Sim Msgs
- Information Exchange
  - Common Requirements
  - Persistent Data Services
  - Non Persistent Data Services
    - Orders, messages, DB updates
    - User defined parameters

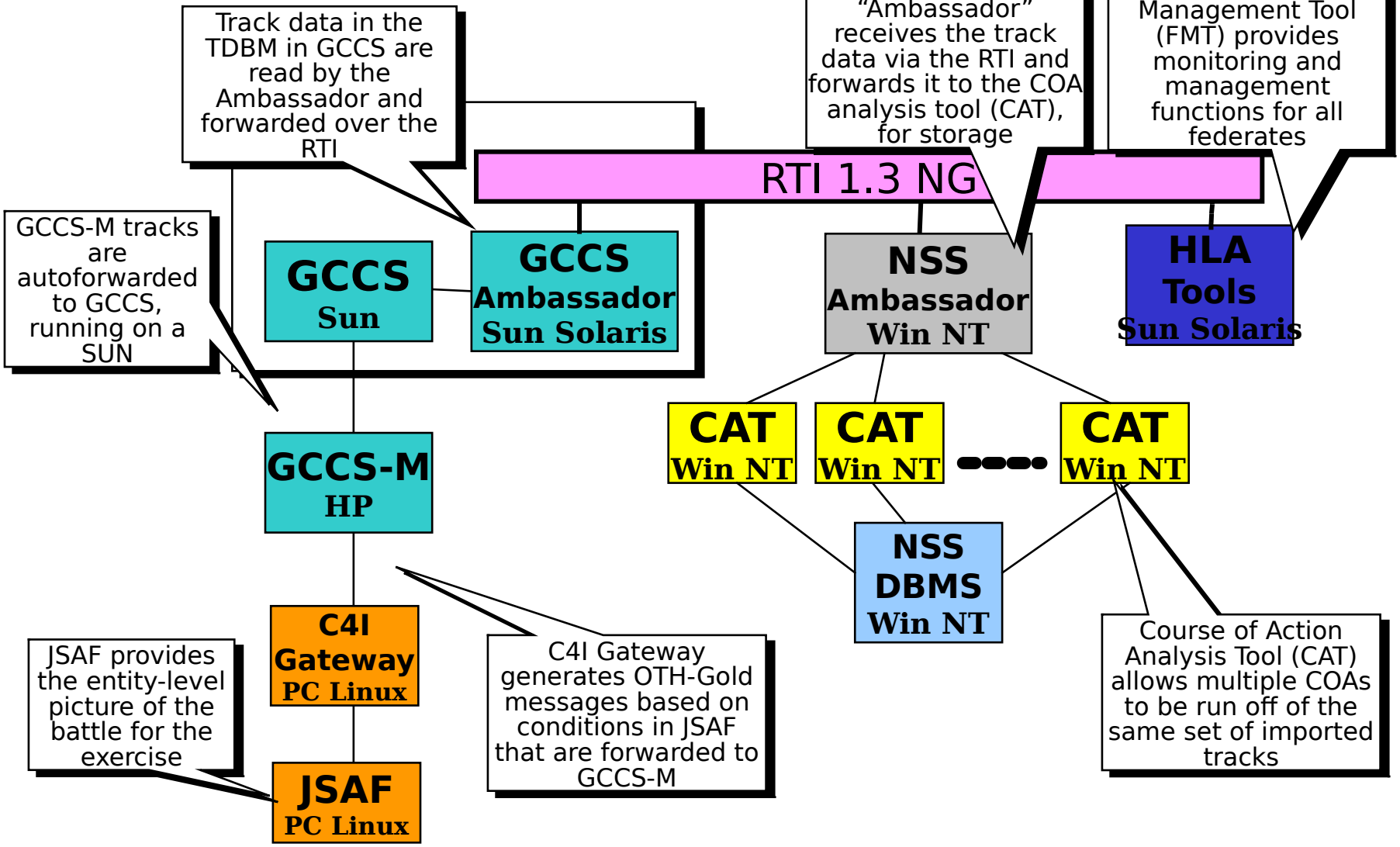
Why Put the RTI into the COE?

- The RTI has been shown to provide many of the same benefits of Sim-Sim interoperability for C4I-Sim interoperability
  - Standard, reuseable interfaces
    - GCCS-JTLS, GCCS-NSS, GCCS-ITEM
    - ABCS-Eagle, ABCS-MODSAF
- Provides a mechanism for C4I systems to use simulation services without having to build them directly into their C4I systems
  - Simulations themselves need not be COE compliant - only the RTI
  - “Loosely Coupled”
- Putting the RTI into the COE allows C4I users to install the RTI on their C4I platforms (as part of a COE download) with the confidence that it will not interfere with other C4I system functions
  - DISA mandated configuration managed process for COE testing and fielding

GCCS - NSS Course of Action Initialization

- Problem:
  - During the Global 2000 exercise at NWC, users of the Naval Simulation System (NSS) required hours to initial a course of action (COA) run, due to the need to manually input data from GCCS (and other sources) into the simulation
    - Long delays for data entry that are prone to error
- Solution:
  - Utilize an existing HLA interface that sent data from NSS *to* GCCS, but reverse the direction of data flow (from GCCS *to* NSS)
- Benefits:
  - Significantly reduced the initialization time and potential for data errors
  - Uses standardized SW components (I.e., HLA) in its implementation
    - Straightforward implementation

GCCS-NSS Configuration Used in Global '01


Track data in the TDBM in GCCS are read by the Ambassador and forwarded over the RTI
The NSS "Ambassador" receives the track data via the RTI and forwards it to the COA analysis tool (CAT), for storage
The Federation Management Tool (FMT) provides monitoring and management functions for all federates
RTI 1.3 NG
GCCS-M tracks are autoforwarded to GCCS, running on a SUN
GCCS Sun
GCCS Ambassador Sun Solaris
NSS Ambassador Win NT
HLA Tools Sun Solaris
CAT Win NT
CAT Win NT
CAT Win NT
GCCS-M HP
NSS DBMS Win NT
C4I Gateway PC Linux
JSAF PC Linux
JSAF provides the entity-level picture of the battle for the exercise
C4I Gateway generates OTH-Gold messages based on conditions in JSAF that are forwarded to GCCS-M
Course of Action Analysis Tool (CAT) allows multiple COAs to be run off of the same set of imported tracks

What the NSS-GCCS Federation DID do at Global 01

- Application in Blue cells huge success
  - Global 00 did not use NSS in the Blue cell - only in the White cell to help adjudicate the battle
  - Use in the Blue cell allowed trainees to conduct COA analysis directly, allowing for more complete analysis of options
- Able to significantly reduce initialization times for NSS
  - During Global 00, manual initialization of NSS for the base scenarios took ~ 4 hours
  - During Global 01 initialization of similar size scenarios took 20 minutes
- Quicker initialization times led to execution of more complex scenarios
  - Typical Global 00 scenario ~ 12 tracks
  - Typical Global 01 scenario ~ 300 tracks

What the NSS-GCCS Federation did ***NOT*** do at Global 01

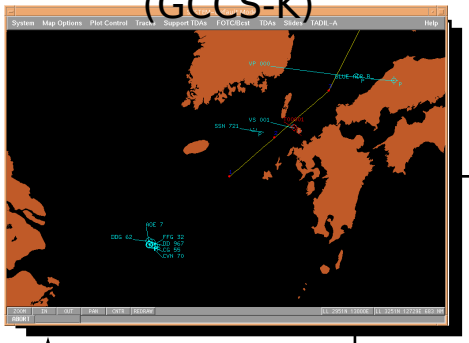
- The development of this interface did not eliminate the man-in-the-loop
  - An NSS operator was still required to execute the runs and collect resulting graphical data
- Data sent from GCCS to NSS did not completely initialize NSS
  - An NSS operator still had to supplement this data with additional information
- While NSS executed, there was no feedback sent back to GCCS
  - All output from COA runs were viewed at NSS terminals

GCCS-NSS FY02 Plans

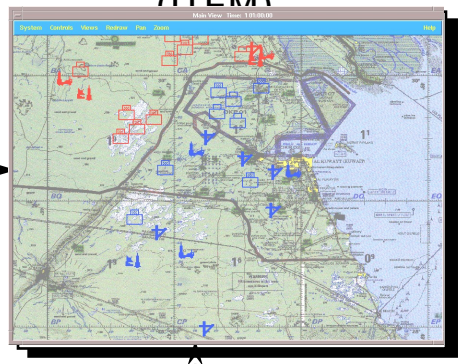
- GCCS-NSS capability to be used as part of FBE-J
  - GCCS Sun, RTI, and NSS CAT tools all to be installed onboard USS Coronado and run during FBE-J
  - Provides an excellent opportunity to evaluate the utility of new technology on Naval planning and analysis
- GCCS-NSS also to be used in NORWEST PAC Exercise (March 2002, NWC)
  - Multi-national exercise involving Japanese, US command forces
- Potential list of enhancements under evaluation
  - Pull in data from Non-COP sources (MIDB, SORTS, etc.)
  - Passing of overlays between GCCS and NSS
  - Two-way exchange of data (replaying COA runs from NSS into GCCS)
  - Automated interpretation of GCCS orders by NSS

Current DMSO C4I-Sim Efforts: The GCCS/K-ITEM COA Federation

Global Command and Control System - Korea (GCCS-K)

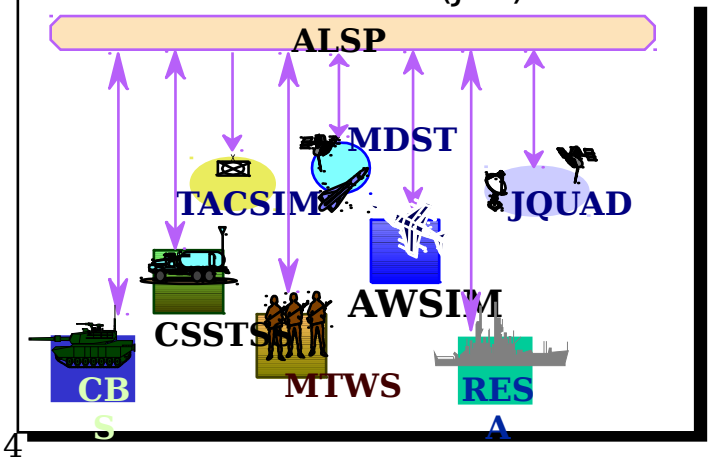


Integrated Theater Engagement Model (ITEM)



HLA Run Time Infrastructure (RTI)

Joint Training Confederation (JTC)



Purpose:

- Provide automated initialization of ITEM COA simulation from GCCS-K

Partners:

- USFK (User Advocate)
- MITRE (Integration and Test)
- NRL (GCCS Ambassador)
- SAIC (ITEM)

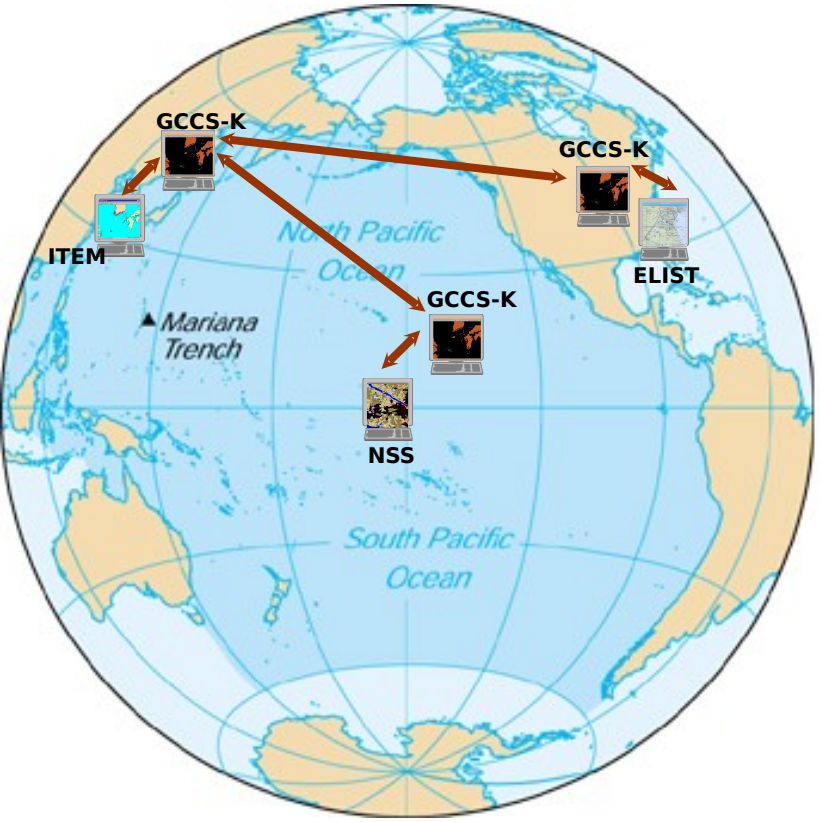
Highlights:

- Reuses much of the existing GCCS-NSS interface
- Will allow the current GCCSK COP picture to be distributed into USFK operations cells for running COAs using ITEM
- Data entry errors eliminated

Status:

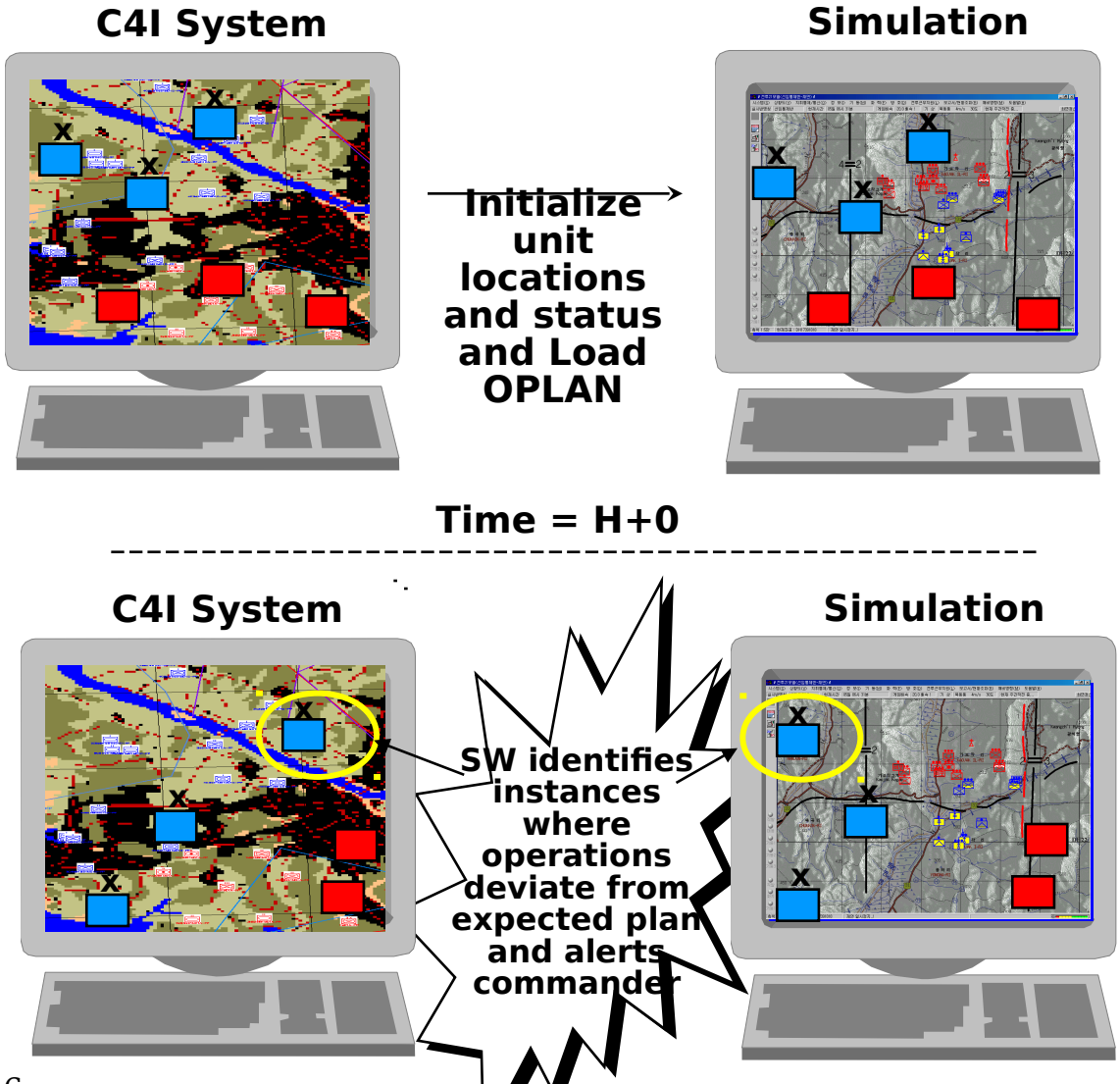
- Task kickoff in August 01
- Integration Test #1, Jan 14-18
- Currently targeting exercise use at KBSC in Spring/Summer 02

Potential Next Steps for COA Application Work: Reachback



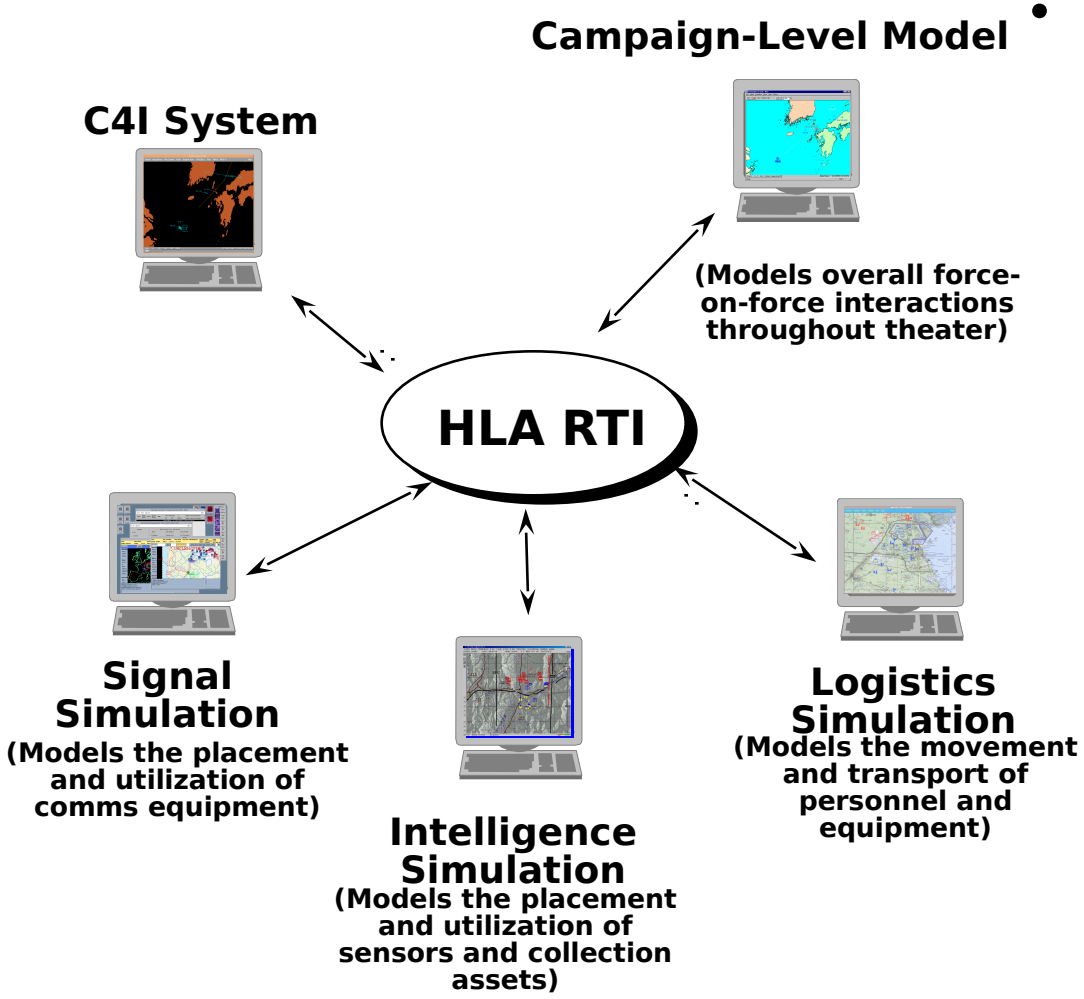
- **Problem:**
  - Current reachback analysis suffers from the same deficiencies described earlier (manual input of data, long lead times)
  - Most methods rely on extracting the tactical picture based on daily powerpoint status updates to the Command Staff
- **Solution:**
  - By collocating simulations with GCCS nodes at distributed locations, different simuations can be initialized and run concurrently
  - Same data can be used with different simulations tailored for analysis objectives
  - Could require extending initialization work to non-HLA compliant simulations (TACWAR, Thunder, etc.) and data sources (MIDB, JOPES, etc.).

Some *Potential* Directions for Future C4I-Sim Efforts Supporting Decision Support


C4I System
Simulation
Initialize unit locations and status and Load OPLAN
Time = H+0
C4I System
Simulation
SW identifies instances where operations deviate from expected plan and alerts commander
Time = H+12

- Active OPLAN Tracking
  - Initialize a simulation with the current tactical picture, drawn from C4I system
  - Load the OPLAN into simulation, either manually or automatically
  - Run the simulation *in real time*, synchronized with data available on a C4I system
  - Use software to monitor the state of both simulation and C4I devices and alert commanders to deviations from the OPLAN

Some Potential Directions for Future C4I-Sim Efforts Supporting Planning


Campaign-Level Model
C4I System
(Models overall force-on-force interactions throughout theater)
HLA RTI
Signal Simulation
(Models the placement and utilization of comms equipment)
Intelligence Simulation
(Models the placement and utilization of sensors and collection assets)
Logistics Simulation
(Models the movement and transport of personnel and equipment)

- Collaborate Simulation Planning
  - Generate a simulation run, using a campaign-level model, that emulates the operations plan (OPLAN)
  - Federate the campaign-level simulation with more detailed simulations (such as logistics models, intel collection, and signal models) to determine how well the OPLAN can be supported
  - Iterate the simulation runs until all planners agree that they have a supportable OPLAN
  - Would be extremely important in applications involving crisis action planning, where no OPLAN currently exists

Summary

- Currently “Scratching the Surface” of C4I-Simulation potential
  - Initialization of analysis simulations an important first step
- DII COE M&S TWG will help facilitate introduction of common M&S solutions that can work with C4I systems
  - Key to preventing “stovepiping” of simulation solutions within separate C4I systems
  - RTI and GCCS Ambassador already undergoing segmentation
  - Technical Requirements Specification (TRS) for M&S available on DISA DII COE web site.
- Significant challenges remain
  - Improving reachback C4I-Simulation capabilities
  - Pulling from additional C4I data sources (MIDB, JOPES, etc.)
  - Automated interpretation of OPLAN (and generation of OPORD) by a simulation